REMARKS

Reconsideration of the application, in light of the above amendments, is respectfully requested.

I. Status of the Claims

Claims 1 and 5 have been amended, no new matter is added.

Claims 1-5 are pending.

II. Status of the Specification

The Abstract has been amended to be 150 words. Withdrawal of the objection is respectfully requested.

III. Rejections under 35 U.S.C. § 102

Claims 1-5 are rejected under 35 U.S.C. § 102(b) as anticipated by Tanida et al. "Compact Image Capturing System Based On Compound Imaging And Digital Reconstruction" (hereinafter "Tanida"). Applicants respectfully traverse the rejection.

Claim 1 has been amended to recite that the:

> micro lens and said light receiving elements are set without alignment error, and preset in the conditions including the distance between object and micro lens array, using the aligning distance of each micro lens of lens array and the focal length of micro lens array, and based on such presetting condition, the magnification ratio of reducing optical system is calculated with the known distance to the object, and by obtaining the relation among one pixel of the reduced image element and its corresponding area of the object, and previously obtain the geometric transfer function T_k describing optical projection from the said real object to create said reduced image element and inverse transfer function T_k^{-1}.

Claim 5 has been amended to recite similar limitations based on the transfer function T_k and the inverse transfer function T_k^{-1}.

Tanida does not teach or suggest such an element because Tanida cannot achieve the recited setting based on his teachings.

As a method for obtaining a single high-resolution image from a plurality of reduced object images, Tanida discloses a method for image reconfiguring by means of arithmetic average method and pseudo inverse method. The arithmetic average method is for reconfiguring a single object image by superposing reduced object images basing their centric positions. The pseudo inverse method is firstly for indicating the object as a photogenic subject and the reduced object images by vectors, and describing a point image distribution function of optical system by matrix. It then for reconfiguring a single object image by calculating the inverse matrix of the point image distribution function mathematically.

Therefore, Tanida's image reconfiguring by means of arithmetic average method cannot obtain a high resolution image. This is because Tanida is merely superposing low resolution reduced images of the photo detector array, thus, the output single object image stays low resolution. There is disparity among reduced object images with the position fluctuation of the object information which is caused by the different observation angle of each lens array and results the resolution of the reconfigured out put image to be low.

Tanida's pseudo inverse method has other difficulties in real world applications. One of ordinary skill in the art is aware that it is difficult to obtain an accurate distance between the object and the micro lens array or between the micro lens array and the light receiving clement, as well as to accurately obtain the influence from the alignment difference of the micro lens array and the light receiving elements. Therefore, it is impossible to accurately describe the point image distribution function.

Furthermore, in the calculation for inverse matrix, since it is impossible to obtain an accurate inverse matrix of the point image distribution function, there is no other than a pseudo inverse as an approximate inverse matrix to be utilized. Consequently, there remains a problem that it is impossible to avoid lowering of the resolution of the object image obtained by reconfiguration using pseudo inverse method.

The amendments to claim 1 of the "micro lens and said light receiving elements are set without alignment error, and preset in the conditions including the distance between object and micro lens array, using the aligning distance of each micro lens of lens array and the focal length of

micro lens array" recite a structure in that the initial image data of the single object is without influence from alignment error of micro lens array and the light receiving elements.

These condition is to be used as the initial value of image data for the reduced image estimating means followed by the iterative control means and then repetitively conducting a estimating processing of the reduced image estimating means as well as a updating processing of the object image updating means until the difference satisfying a predetermined condition. In this process, the image distribution function can then be described more accurately and can output a high resolution image data of the single object image at the time of the difference satisfying the predetermined condition as a final image data of an object image. Tanida cannot achieve such a setting as claimed in amended Claim 1.

Further, claim 1 is amended to recite "an estimated image of each of said reduced object images from an image data of a provided single object image which comes from said generating means of initial object image, based on a geometric projection process where said transfer function T_k is used."

In contrast, Tanida discloses a method for image reconfiguring system which does not generate the initial image data of single object image from the plural reduced image data captured by the micro lens array under the claimed preset condition. Therefore it can not obtain the same level of high resolution image data as that of amended Claim 1.

Additionally, claim 1 is amended to recite that the reduced image estimating means estimates generating an initial image data of a single object image based on an image data of a plurality of the reduced object images captured by the micro lens array under the known condition using the transfer function T_k.

Thus, the single object image can obtain high resolution which is to be updated image data of the single object image provided in the reduced image estimating means. The high resolution is obtained by projecting a difference between the estimated image of each reduced object images which comes from the reduced image estimating means and each of the reduced object images which is captured under the known condition of micro lens array in an inverse process (T_k^{-1}) of the geometric projection process. These reduced image estimating means as well as its inverse process are inevitable means to obtain high resolution image in the image configuring system.

In contrast, Tanida discloses the projection means only from reduced object image to a single object image and it is the inverse process of the estimating reduced image means amended Claim 1. Furthermore, Tanida's disclosure shows merely the correspondence among reduced image and the single object image to be one to one and the opening spread of the light receiving element is not considered. Tanida has a fundamental limitation to obtain a high resolution image (picture quality) in the image reconfiguring system without considering the opening spread of the light receiving element.

Claim 1 further recites that:

> an object image updating means for updating an image data of said single object image provided in said reduced image estimating means by projecting a difference between said estimated image of each reduced object images which comes from said reduced image estimating means and each of said reduced object images which is captured under said known condition of micro lens array, in an using said inverse process T_k^{-1} of said geometric projection process.

In contrast, the process of Tanida's object image update means shown from Figure 9(c) to 9(d) is a linear arithmetic average method to obtain the missing pixel. In the pixel rearranging means, it is completely different process from the process claimed above in which the object image updating means is using the inverse process, or back projecting, a difference between the estimated reduced object image and the reduced object image. Tanida's image reconfiguring system does not have the claimed inverse process (back projecting) of geometric optical projection.

Furthermore, claim 1 originally recited that the:

> iterative control means... repetitively conduct[s] an estimating processing of said reduced image estimating means as well as an updating processing of said object image updating means until said difference satisfying a predetermined condition, then outputting an image data of said single object image at the time of said difference satisfying said predetermined condition as a final image data of an object image.

This process is shown in Figure 2, steps S30-S60, of the present application and is a different process than the one in Tanida's image reconfiguring system. Further, in contrast, the

iterative process in Tanida's image reconfiguring system is the process for calculation of the image data error caused from the alignment difference of the micro lens array and the light receiving elements. The alignment difference is calculated using a total of 6 parameters which are 3 parameters from three directions and 3 parameters from three angles.

As explained above, Tanida's image reconfiguring system and amended Claim 1 are compared on each technical elements and concluded as different invention. In case of amended Claim 1, following items are engineering presetting matter that the distance between object and micro lens array is set so that the aligning distance of each micro lens of the lens array is set and that focal length of micro lens array is set. Further, it is also condition that said micro lens and said light receiving elements are aligned with no alignment error. Based on such presetting condition, it is anticipated the magnification ratio of reducing optical system calculated with known distance to the object as well as the relation among reduced image element and its corresponding area of the object. Consequently it is obtainable the geometric optical projection transfer function T_k from the said real object to create said reduced image element and inverse transfer function T_k^{-1} in advance. These are recited in amended Claim 1 and not disclosed or suggested in Tanida's system.

As stated above, the geometric optical projection (transfer function T_k) from the real object to create said reduced image element and its back projection (inverse transfer function T_k^{-1}) are prepared to be used to the following each step processes that arc initial object image creation, reduced image estimation and object image updating. Therefore the claimed image reconfiguring system can achieve a higher resolution object image than Tanida's image reconfiguring system.

Thus, amended Claim 1 is not anticipated or rendered obvious by Tanida. Claim 5 recites similar elements as a method and is distinguished over Tanida for the same reason above. Claims 2-4 depend from claim 1 and are allowable based at least on the arguments above. Applicants respectfully request that the rejections be withdrawn.

CONCLUSION

In view of the above amendments and remarks, Applicants believe the pending application and all pending claims are in condition for allowance, and earnestly solicit same.

If the Examiner feels that any remaining issues can be resolved by a Supplemental or an Examiner's Amendment, the Examiner is respectfully requested to contact the undersigned at the telephone number indicated below.

Dated: April 21, 2009

Respectfully submitted,

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